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Resource Notes

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CALMIT helps firm monitor carbon, contain greenhouse gases

An agreement has been signed between a University of Nebraska-Lincoln program and an Iowa company to help farmers sell to utilities credits they receive for fixing carbon in crop residue and soil, in accord with the Kyoto Protocol for greenhouse gas reduction.

CQuest Ltd. of Des Moines, named after the carbon sequestration it markets, and the Affiliated Research Center (ARC) of the UNL Center for Advanced Land Management Information Technologies (CALMIT) are working on the project with NASA, sponsor of the ARC program. Begun about 18 months ago, the program seeks commercial applications of remote sensing and related technologies for the Great Plains.

CQuest wants to use satellite imagery to identify tillage practices that leave crop residue in the field, called "reduced tillage," and verify compliance with CQuest contracts. In addition, NASA is testing feature-extraction software that can help identify the relevant tillage practices in a given image, explained Al Peters, CALMIT geoscientist heading up the ARC.

"If we can acquire the image before planting, say, at the end of April, we can determine what farmers have used in the way of tillage practices," Peters said.

Carbon sequestration has become an increasingly important environmental issue as industries and governments worldwide collaborate to reduce green-

Greenhouse gases *continued on p. 2.*

Grant allows CSD to complete automation of huge set of statewide well records

With a grant from the Nebraska State Records Board, the state's geological survey and its Department of Water Resources will be able to complete the automation of the largest data base on groundwater geology in the state.

An award of $24,805 should allow the project to be finished in about a year, explained Michael Jess, associate director of the Conservation and Survey Division of the University of Nebraska-Lincoln and former director of DWR.

The automation means that anyone seeking data from the drilling of the state's 115,000 water wells can find it through the web site of the new Nebraska Department of Natural Resources, formed from the merger of DWR and the state Natural Resources Commission. Work is well underway on this huge data-entry job after a number of false starts since the mid-1960s.

"In the past, the department (of Water Resources) had problems with the technical aspects of automating this kind of data and with finding the resources, the people, to pull it off. It's not quite 'Y2K,' but it's a little bit like that," Jess said. "Conservation and Survey was able to secure money for the student help to perform this time-consuming data-entry task."

The geologic information from nearly two-thirds of the wells is already available in a computerized data base that can be searched by well location, number, owner and other attributes. Previous funds from the Nebraska Information Technology Commission, DWR and CSD allowed that work to be done.

Wells data *continued on p. 2*

America's Farm connects agriculture to classrooms via Internet

Remote sensing and GIS for farming taught from educational web site

Collaboration between the University of Nebraska-Lincoln's center for remote sensing and geographic information systems and the Office of Internet Studies at the University of Nebraska at Omaha has produced an experiment in agricultural learning that features data from a working farm transmitted to classrooms in real time.

The UNL Center for Advanced Land Management Information Technologies (CALMIT) and UNO are using "America's Farm," as the cooperative effort is called, to highlight agricultural applications of remote sensing, which are methods of assessing earth conditions from a distance, and geographic information systems (GIS), computerized means of analyzing spatial data.

These sophisticated technologies will be explored through the delivery of near-real-time data on farm operations to high school and college classrooms. The result of a $700,000, three-year grant from NASA, it will also feature web-camera video and views of the farm from aircraft and satellites. America' s Farm is located on the University of Nebraska 9,500-acre Agricultural Research and Development Center near Mead, where CALMIT already conducts much of its research on remote sensing and agriculture.

"The college course could eventually be cross-listed through UNL and is part of a new format in education designed to use multi-disciplinary intelligence to address open-ended questions," explained Rick Perk, education coordinator for CALMIT, a joint program of the Conservation and Survey Division and the School of Natural Resource Sciences.

The final web product will include background information about farming, remote sensing, mapping, GIS and global positioning systems (GPS), which are satellite-based means of determining exact location. It will also feature views of rural life, including farms and their surroundings, from the ground level, the air and satellites; data collected and integrated from the field, the air or satellites; and tutorials on the application of the technologies. Inquiry-based scenarios, developed around the resources, will require

America's Farm *continued on p. 3.*

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Institute of Agriculture and Natural Resources/University of Nebraska–Lincoln

Greenhouse gases *continued from p. 1*

house gas emissions, believed to be responsible in part for global warming. The carbon-emission credit is defined as the equivalent of the warming effect of a metric ton of carbon dioxide removed from or not added to the atmosphere, CQuest literature said.

"One method of efficiently and economically encouraging greenhouse gas mitigation efforts is to provide a trading system whereby emitters can buy effective mitigation efforts from others who can better avoid emissions or scrub the air of greenhouse gases," CQuest said.

Some 20 million tons of emission credits have been sold in recent years and 100 million tons are expected to be sold in the year 2000, the company said. The credits themselves are purely information products, not an actual commodity, so the sales system depends on the accuracy of the data that creates them, Peters said. Since field verification is labor-intensive and expensive, and even partial field sampling cuts trading value by about 4 percent, remote sensing should cut these costs.

The ARC program offers companies low-risk opportunities to find applications for remote sensing — satellite and aerial imagery — and related technologies, which include geographic information systems — computerized means of analyzing spatial data. Projects typically tackle one or two issues and run six to nine months.

Other signposts of success for the ARC are:

– A special issue of the prestigious professional journal Photogrammetric Engineering and Remote Sensing will be devoted to commercial applications of remote sensing, featuring the nine universities in the nation chosen as incubators for the technology-transfer initiative. Peters and CALMIT Director Don Rundquist will serve as guest editors of the November 2000 issue.

– Also underway is another year 2000 project with two Iowa companies to improve white corn genetics related to protein content. Remote sensing will detect water or nitrogen deficiencies.

– The last of four 1999 projects is complete. In it, Golden Harvest, a seed company in Waterloo, Neb., wanted to create a digital map of zones of agricultural ecology and vegetative conditions linked to an interactive, Web-based tool to support cropping choices.

These accomplishments follow on the heels of a successful first year in which projects were completed with three agronomic businesses and one oil and gas firm. In 1998, a $600,000 grant from NASA created the Affiliated Research Center at CALMIT, a joint program of the Conservation and Survey Division and the School of Natural Resource Sciences. Until recently, these technologies have been used almost exclusively by government and university scientists. Many private companies are interested in them but steep start-up and training costs were obstacles.

Wells data *continued from p. 1*

The immediate benefits are largely to the business community, such as well drillers and environmental or engineering consultants, and to the regulatory community, Jess said. But the public will also reap the rewards of this extensive source of geologic information whenever wells or landfills are sited, groundwater pollution has to be cleaned up or prevented, water supplies must be supplemented or stream-aquifer interaction has to be better understood. The records list sediment size over depth and other characteristics such as static water level, pumping water level, well completion date, acres irrigated and pumping volume, among many other characteristics.

The state legislature required that DWR register all irrigation, municipal, domestic and industrial wells in 1957, said Jess, who is also a water resources engineer with CSD, a unit of the Institute of Agriculture and Natural Resources, and senior lecturer with the UNL School of Natural Resource Sciences.

Early records were kept on paper, but with the advent of center-pivot irrigation, well installations increased dramatically and it became increasingly difficult to find the right information easily. In the mid-1960s, DWR tried to automate the records using the punch-card system required by the mainframe computers of the time. But this approach became too cumbersome, he said. Later attempts by state systems analysts and commercial firms also failed.

Currently, the data can be found on the web site of the former NRC at http://www.nrc.state.ne.us under "Site Map," then "Spatial/GIS Databases," and then "Registered Groundwater Wells." The commission merged with DWR on July 1 to become the Department of Natural Resources. Its new web address is to be http://www.dnr.state.ne.us.

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***Resource Notes* is a quarterly publication of the Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln, 68588-0517.** To receive it free of charge, write to the postal address above or the email address on the left. **The Conservation and Survey Division (CSD) is the agency designated by statute to investigate the natural resources of the state, to make available to the public the results of these investigations and assist in the development and conservation of these resources.** CSD and UNL provide information to all people regardless of gender, age, race, disability, race, color, religion, marital or veterans's status, national or ethnic origin, or sexual orientation. Background of the nameplate depicts the rock column from the *Geologic Bedrock Map of Nebraska*. Shown are (from bottom) Precambrian, Cambrian, Ordovician, Silurian and Devonian rocks.

Latest geologic quadrangle adds surface information as well as bedrock

Broken Bow quad to be published in August, means 8 of 11 quads are done statewide

The most recent contribution to a statewide geologic mapping project should be published this August and includes three features not seen on the seven such quadrangles previously published. These additions include three cross sections and two smaller maps showing the base of the top unit of bedrock and the reliability of the data, respectively, explained Robert F. Diffendal, Jr., research geologist at the University of Nebraska-Lincoln Conservation and Survey Division.

"These cross sections and the data on the configuration of the base of the Ogallala Group are important in terms of locating and understanding water resources, as well as for sand and gravel and other minerals," Diffendal said. "The reliability diagram helps people understand where the data are quite good and where they are generally just adequate."

The Broken Bow quadrangle, published by the U.S. Geological Survey (USGS), is one of 11 geologic quadrangles 1 degree in latitude by 2 degrees in longitude that will cover the state. It covers all or major parts of Blaine, Boone, Custer, Garfield, Greeley, Howard, Loup, Merrick, Nance, Sherman, Valley and Wheeler counties and was mapped by Vernon Souders, a now-retired CSD research geologist. Diffendal has worked with the USGS to review the work and complete the publication process since Souders stepped down at the end of 1998. Part of a long-term cooperative mapping project with the USGS begun in the 1960s, this publication means only three more quadrangles remain to be published.

When the mapping project began, Diffendal said, it was important to map the bedrock, largely because the greatest needs were related to oil and gas exploration and water supply. All but the most recent quads, those of the North Platte and Scottsbluff areas, reflect that emphasis. In the last 20 years or so, largely due to the importance of groundwater quality and other environmental geology concerns, the USGS has begun to emphasize the mapping of surface geology. While it was begun during the era of the previous emphasis, the Broken Bow quad does provide general information on surface deposits through the cross sections and other supplementary data, Diffendal explained.

America's Farm *continued from p. 1*

that students research a problem, develop questioning skills, acquire and analyze data and generate a set of conclusions.

All of the individual pieces will be put into a web-delivered graduate course. A pilot course for educators was taught during the spring semester through UNO. Course revisions are being made based on feedback from participants, and it should be offered nationwide next fall.

America's Farm also has resulted in a plan to incorporate the nation's first "technology track" into the curriculum at Mead High School, one of a select group of magnet schools for agriculture in the country. The track would allow students to specialize in high technology such as remote sensing and GIS, Perk added.

"There are about a half dozen agriculture magnet schools across the country, but none has a technology track. The technology track is going to make this truly unique. The meat of the Magnet School's technology track will focus on the technological concepts incorporated in "America's Farm," he said.

Don Rundquist, director of CALMIT explained, "America's Farm was one of only seven proposals funded out of 180 submitted to the NASA LEARNERS grant program in 1999. The idea is to give students and teachers access to a real, working Midwestern farm, and to deliver various kinds of data in a package that teachers can use, all over the web."

In general, Perk explained, America's Farm was created for a variety of reasons. These are: to educate a relatively uninformed public about farming by using the students' natural curiosity about farms; to take advantage of an emerging emphasis on "precision" or computer-assisted, site-specific agriculture; to explore advances in remote sensing, GIS and GPS; to augment the teaching of vocational agriculture; to educate producers and farm managers; and to explore practical applications of remote sensing.

Former director of Water Resources now associate director of Conservation and Survey

The new associate director of the University of Nebraska Conservation and Survey Division (CSD) has said he wants to emphasize assisting local governmental units, such as irrigation and natural resources district boards, in understanding better how the system can work for them. The university needs to do a better job of helping them get the information they need for far-sighted management of the state's natural resources, he added.

"The division has been out in front with technical information, but this is a side of water issues directly related to water and yet not to the physical aspects. It's working the government of water, or other natural resources, that needs some attention," said Michael Jess, also senior lecturer with the University of Nebraska-Lincoln School of Natural Resource Sciences and former director of the state Department of Water Resources (DWR).

Sometimes locally elected officials have a tough time handling the resource responsibilities given them. They don't lack the brains or the willingness, but sometimes the education they need in advanced civics has been lacking, Jess explained.

In addition to the university's traditional service role with adult learners, Jess believes it can do more to help undergraduates become more adept at working in and with the local forms of government they will encounter, he said.

"Mike has a wealth of experience in natural resources and related policy matters that should be of great value to the division, the university and the state," said Mark Kuzila, CSD director. "In addition, this appointment should give the division some significant visibility in water issues."

A water resources engineer, Jess assumed the duties of CSD associate director, a half-time position, on July 1. He

Associate director *continued on next page*

will also continue to work with the School of Natural Resource Sciences in the planning of the annual Nebraska Water Conference and other duties. Jess joined the division in March 1999 after serving as director of DWR since 1981. He also worked for CSD and the U.S. Army Corps of Engineers before becoming a hydrologist for the Illinois Water Survey in 1972. He became deputy director of DWR in 1975.

Joeckel to continue legacy of mineral resource work and Paleozoic, Mesozoic mapping

The most recent addition to the geology faculty at the Conservation and Survey Division will focus on geologic mapping and analysis of the oldest rocks exposed in the state, environmental geology and the mineral resources industries, as well as general service activities.

More specific research objectives of Matthew Joeckel, a CSD research geologist who was formerly assistant professor of geology and geography at Bellevue University in Bellevue, include the stratigraphy, mineralogy, and geochemistry of the Dakota Formation, a secondary aquifer in eastern Nebraska; cyclic sedimentation of the Pennsylvanian strata called "cyclothems," including the documentation of ancient soils and land surfaces; and mapping of surface geology, including saline and alkaline wetlands, Joeckel said. Analysis of the weathering of the Dakota may yield insights into surface and groundwater quality, he added.

"It's a great honor to be working for the CSD, and I foresee tremendous opportunities," Joeckel said. "I'm extremely pleased to be selected for the position, especially because I will be following a tradition of excellence established by Ray Burchett."

Joeckel will continue Burchett's legacy of service to the mineral resources industries of the state, helping to compile the annual mineral industry inventory and assisting the sand and gravel, limestone, shale and other industries in finding economic quantities of these minerals. He will also fill the role performed by Burchett, formerly a CSD geologist, by mapping the Mesozoic and Paleozoic rocks of the state, those deposited between about 570 and 66 million years ago.

Joeckel has a doctorate in geology from the University of Iowa and did graduate work at the University of Kansas and the University of Florida. He has a master's and bachelor's from the University of Nebraska-Lincoln. He brings with him experience working with CSD during the summer of 1999 on the STATEMAP program, a cooperative geologic mapping project with the U.S. Geological Survey.

He also has been an adjunct assistant professor with the division since November 1998, an adjunct assistant professor with the UNL Department of Geosciences since January 1997, and a research associate of the University of Nebraska State Museum for several years. From September 1994 to July 1996, he was a National Science Foundation post-doctoral research fellow at the University of Tennessee-Knoxville.

New publications from the Conservation and Survey Division, 1999-2000

LUM-36 **Center-Pivot Irrigation Systems in Nebraska, 1997**: Tooze, M. and others (1:1,000,000; 2000) - $5

GMC-31 **Geologic Map of the Broken Bow 1 Degree x 2 Degrees Quadrangle, Nebraska**: Souders, V. L. (2000) - TBA
THR-1 **Adams County Test Hole Log Book** (1999) - $6
THR-7 **Box Butte County Test Hole Log Book** - (2000) - $9
THR-10 **Buffalo County Test Hole Log Book** (2000) - $13
THR-13 **Cass County Test Hole Log Book** (1999) - $10.50
THR-15 **Chase County Test Hole Log Book** (2000) - $9
THR-17 **Cheyenne County Test Hole Log Book** (1999) - $12
THR-24 **Dawson County Test Hole Log Book** (1999) - $11
THR-25 **Deuel County Test Hole Log Book** (1999) - $8.00
THR-28 **Douglas County Test Hole Log Book** (1999) - $7.50
THR-37 **Gosper County Test Hole Log Book** (2000) - $9
THR-40 **Hall County Test Hole Log Book** (1999) - $10
THR-41 **Hamilton County Test Hole Log Book** (1999) - $7.50
THR-47 **Howard County Test Hole Log Book** (1999) - $9
THR-50 **Kearney County Test Hole Log Book** (1999) - $7.50
THR-53 **Kimball County Test Hole Log Book** (2000) - $11.50
THR-61 **Merrick County Test Hole Log Book** (1999) - $6
THR-63 **Nance County Test Hole Log Book** (1999) - $4.50
THR-69 **Phelps County Test Hole Log Book** (1999) $7.50
THR-84 **Stanton County Test Hole Log Book** (1999) - $5
THR-90 **Wayne County Test Hole Log Book** (1999) - $4.50
THR-93 **York County Test Hole Log Book** (2000) - $9
EC-11a **Geology of Rock Creek Station State Historical Park**: Diffendal, Robert F., Jr. (revised 1999) - $7
GIM-131 **Shaded Relief Map of North America**: USGS (1:10,000,000; 2000; 39"x 43½") - $6
(Use order number. Add sales tax and $4 for first class postage.)